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Office of River Protection, State of Washington Department of Ecology
Tank Waste Retrieval Work Plan/Functions and Requirements Change Notice
(Per Hanford Federal Facility Agreement and Consent Order Section 9.3)

1. Document Title and Number: RPP-22520, Rev. 8, 241-C-101 and 241-C-105 Tanks Waste Retrieval Work Plan		
2. Minor Field Change: (Section 12.4 HFFACO Action Plan) ☐ Yes: (WRPS Signature Only – Attach signed form to Primary Document for record purposes) x No: Proceed to Box 3	**3.** Document Issue Date: 03/18/14 **4.** Document Modification Notice Date: 1/18/16	**5.** Notice Number: 2016-01
6. Do proposed changes require schedule changes? (Would this extend completion of retrieval beyond 12 months from date of initiation?) Yes x No	**7.** Do proposed changes include specific additions, deletions, or modification to scope and/or requirements which affect the overall intent of the plan? ☐ Yes x No	**8.** (Check only one box) ☐ Significant Modification (Check if the answer to question in <u>either</u> section 6 or 7 is "yes". Significant modifications require revision of the primary document.) Minor Modification x Requires modification of the document x Can be accomplished with Modification Notice.

9. Description and Justification of Change:

Change Description:
A third technology is needed to retrieve the waste from tank 241-C-105. The third technology requires equipment and operational changes and that are described in the modified TWRWP.

Justifications:

- Section 1, page 1-1: updated the leak status of C-105 and updated the Consent Decree reference.
- Section 2.1, page 2-1: Updated retrieval schedule status.
- Section 2.4, pages 2-6 and 2-12: updated the least status of C-105.
- Section 2.5, page 2-13: Deleted reference to HFFACO Appendix I.
- Section 3.0, page 3-1: Identified the third technology and updated Consent Decree reference.
- Section 3.1.1, page 3-2: Described changes necessary for third technology.
- Section 3.1.1, page 3-5: Updated riser use table.
- Section 3.1.3, page 3-8: Clarified that the operating description applied to C-101.
- Section 3.1.3, page 3-9: Updated C-105 operating description for third technology.
- Section 3.1.3, page 3-12: Updated Consent Decree reference.
- Section 3.1.4, page 3-12 to 3-13: Added Section 3.1.4 Chemical Dissolution Process.
- Section 3.2, page 3-15: Clarified wording in two sentences.
- Section 3.3, page 3-20 to 3-21: Added rationale for third technology selection and updated Consent Decree references.
- Figure 3-3, page 3-24: Replaced C-105 equipment sketch with a sketch of the third technology equipment.
- Table 3-5, page 3-27: Updated Consent Decree reference.
- Section 4.0, page 4-1: Updated Consent Decree reference.

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- Table 3-5, page 3-27: Updated Consent Decree reference.
- Section 4.0, page 4-1: Updated Consent Decree reference.
- Section 4.1.2, page 4-3: Corrected sentence with a missing word.
- Figure 4-3, page 4-7: Figure was modified to account for tanks in retrieval status not being actively retrieved.
- Section 4.2.1.1, page 4-8: Added requirement for obtaining gamma scans before deploying the third technology in C-105.
- Section 5.0, page 5-1: Updated Consent Decree reference and clarified sentence.
- Section 7.0, page 7-1: Added missing words, deleted incorrect words, and updated Consent Decree reference.
- Section 9.0, pages 9-2 and 9-9: Reference update and added reference for the system engineering evaluation.

See the attached redline strikeout pages.

10. Impact of Change:

The change will allow the third technology to be deployed and will enhance the retrieval of waste from C-105. There is increased risk that the third technology retrieval actions will cause the tank to leak or resume leaking.

11. Additional Requirements and/or Provisions

The high resolution resistivity (HRR) leak detection system data analysis will be changed to provide additional leak detection sensitivity to the area with previously contaminated soil. There is speculation that C-105 leaked in the past and that the tank waste sealed the leak. A data focus area will be created that will allow for additional evaluation of the data obtained from the contaminated soil area between C-104 and C-105. If a past leak were to resume, it is reasonable to assume that waste would leak in the same area again.

Approvals

Washington River Protection Solutions, LLC.	Office of River Protection	State of Wash., Dept. of Ecology
☐ Provisional Approval[2] Date	☐ Provisional Approval[2] Date	☐ Provisional Approval[2] Date
☒ Final Approval Date 7/14/16	☒ Final Approval Date 7/19/2016 for G. Trenchard AMTF	☒ Final Approval Date 7/20/2016

Notes

1 - For use by Ecology to identify any additional information needed to make a decision regarding the request for modifications. In addition, Ecology will identify actions, if any, regarding the modification request that DOE may take pending Ecology's final decision
2 – Provisional approval allows DOE and it's contractors to take specific actions identified in section 11, prior to final approval of this modification.

1.0 INTRODUCTION

The U.S. Department of Energy (DOE), Office of River Protection (ORP) River Protection Project mission includes storage, retrieval, immobilization, and disposal of radioactive mixed waste presently stored in underground tanks located in the 200 East and 200 West Areas of the DOE Hanford Site. Tank 241-C-101 (C-101) will be retrieved with modified sluicing (MS) and tank 241-C-105 (C-105) will be retrieved using the mobile arm retrieval system vacuum (MARS-V) waste retrieval technology. The basis for the retrieval technology selected is as follows:

Tank C-101 is classified as an 'assumed leaker' in HNF-EP-0182, *Waste Tank Summary Report for Month Ending September 30, 2011*. The tank history was reevaluated as described in RPP-ENV-33418, *Hanford C-Farm Leak Assessments Report; Tanks 241-C-101, 241-C-110, 241-C-111, 241-C-105 and Unplanned Waste Releases*, Rev. 1. No conclusion was reached during the reevaluation, but subsequent analysis and new data (see section 2.4.1) allowed for qualifying the tank in the "assumed leaker" tank status. There is sufficient evidence to conclude that there were and are no tank leaks below 54". Soil contamination in the drywells was likely from near surface events such as small leaks from spare inlet nozzles.

Tank C-105 is classified as an ~~sound tank~~assumed leaker; ~~however,~~ vadose zone characterization data collected around tank C-105 indicates that an unplanned release occurred near tank C-105 (see section 2.4.2.1). Because the cause or source of this unplanned release cannot be confirmed, the MARS-V was selected for retrieving the waste from tank C-105 to minimize the potential for leakage to occur. This document was originally developed to meet the requirements identified in the *Hanford Federal Facility Agreement and Consent Order* (HFFACO) for Tank Waste Retrieval Work Plans (TWRWP). As of 10/25/10, the Consent Decree in *State of Washington v. Department of Energy*, Case No. 08-5085-FVS[1] ~~(Decree)~~ ~~became~~ has provided the regulating direction for TWRWPs for tanks that are required to be retrieved ~~as Project B-1 and Project B-4 of~~under the Consent Decree. ~~The purpose of t~~This ~~document~~ TWRWP is ~~to provide~~being submitted in accordance with the Consent Decree, Appendix C, Part 1, Required Retrieval Technologies: "If the waste residual goal of 360 cubic feet is not achieved using the established two technologies, an additional retrieval technology **established in a revised TWRWP** shall be deployed to the 'limits of technology…(emphasis added)." ~~the Washington State Department of Ecology (Ecology) information on the planned approach for retrieving waste from tanks C-101 and C-105 to allow Ecology to approve the waste retrieval activity in Project B-1.~~

Where information regarding treatment, management, and disposal of the radioactive source, byproduct material and/or special nuclear components of mixed waste (as defined by the *Atomic Energy Act of 1954*) has been incorporated in this document, it is not incorporated for the

[1] As amended by Amended Consent Decree, Case No. 08-5085-RMP (March 11, 2016) and Second Amended Consent Decree, Case No. 08-5085-RMP (April 12, 2016). The TWRWP requirements of the October, 25, 2010 Consent Decree were not modified by either the Amended Consent Decree or the Second Amended Consent Decree.

2.0 TANKS AND/OR ANCILLARY EQUIPMENT CONDITION AND CONFIGURATION AND WASTE CHARACTERISTICS

2.1 RETRIEVAL START DATES

~~The current baseline includes initiating waste retrieval from~~ ~~T~~tank C-101 retrieval started in ~~November 2012~~December 2012 and waste removal actions completed in September 2013. Tank C-105 retrieval started in June 2014 and ~~tank C-105 in August 2013. Completion dates are specified in the Decree. The completion date for Project B-1, complete retrieval from the remaining SSTs in WMA-C, is 9/30/14.~~is forecast to complete in 2017.

2.2 TANK HISTORY

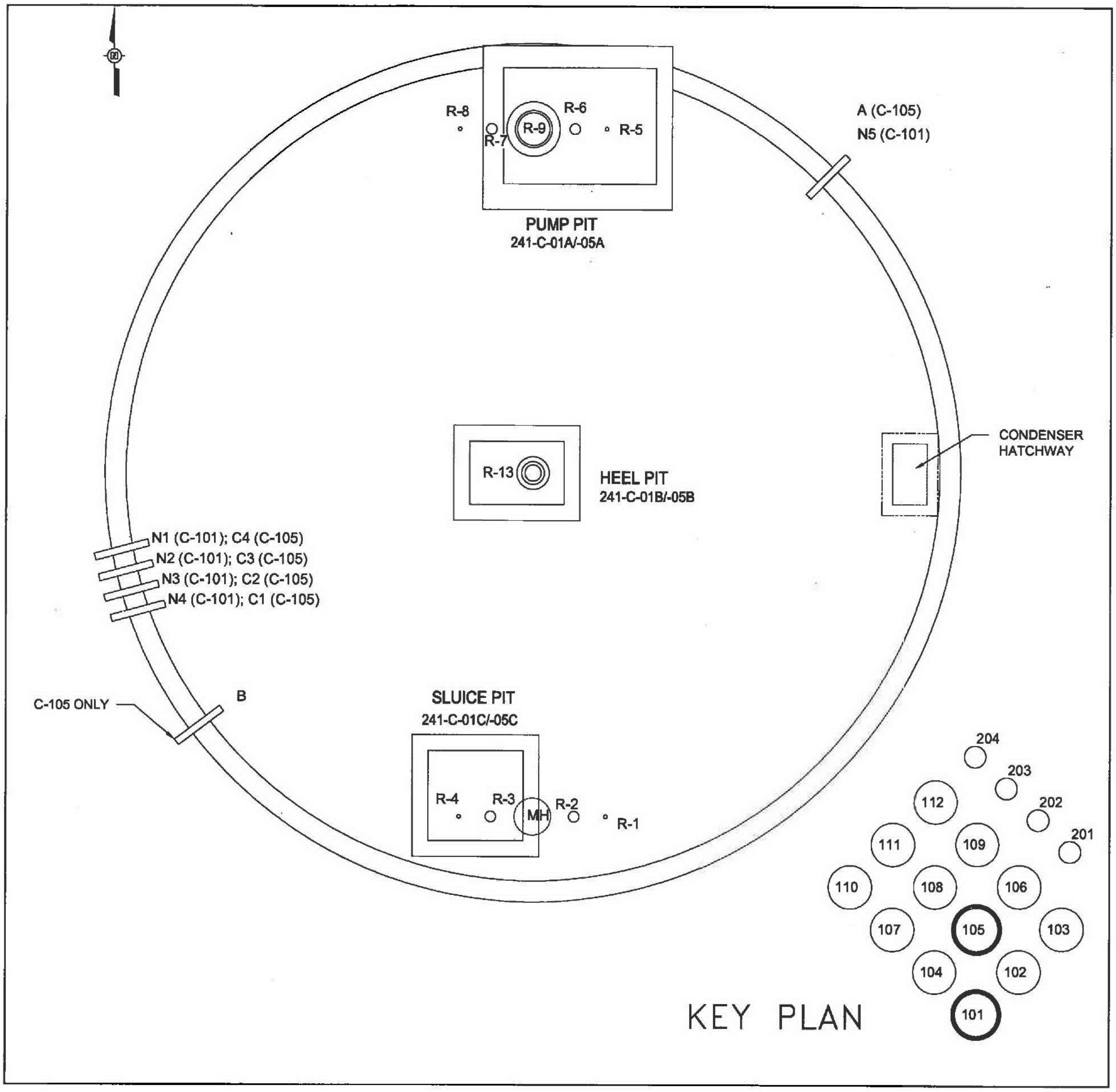
This work plan addresses waste retrieval from two 100-series tanks, C-101 and C-105, located in the C tank farm in the 200 East Area (Figure 2-1). Summary-level historical data related to the configuration and operating history for these tanks are provided in Table 2-1.

Table 2-1. Summary-Level Tank Data.*

Tank	C-101	C-105
Constructed	1943-44	1943-44
In service	1946	1947
Diameter (ft)	75	75
Operating depth (in.)	185	185
Design capacity (gal.)	530,000	530,000
Bottom shape	Dish	Dish
Ventilation	Passive	Passive
Nominal burial depth (ft)	6	6
Declared inactive	1977	1980
Interim stabilized	11/83	10/95

* Best-basis inventory AutoTCR documents (6-10-2005) from TWINS, Web Site - http://twinsweb.pnl.gov/twins.htm.
TWINS = Tank Waste Information Network System.

Figure 2-3. Tanks C-101 and C-105 Riser and Fill/Cascade Line Plan View.



2.4 TANK CLASSIFICATION

Tanks C-101 is classified as an 'assumed leaker' and tank C-105 is classified as '~~sound'~~ assumed leaker' in HNF-EP-0182. A description of the 100-series tanks is provided in RPP-13774, *Single-Shell Tank System Closure Plan*, Appendix C, Section C2.0.

2.4.1 Tank C-101

Tank C-101 has been classified as an assumed leaker in HNF-EP-0182 since this monthly document was first issued in 1988. This document provides an estimated tank C-101 leak

2.4.2 Tank C-105

Tank status is officially declared in HNF-EP-0182. The report HNF-EP-0182 is a summary report that includes tank status and tank leak volume estimates. Reports, records, data, and a probabilistic assessment process are used to determine the status of the tank and subsequently a leak volume.

~~Although t~~Tank C-105 is designated as a '~~sound'~~ assumed leaker' tank in HNF-EP-0182, as a result, in part, ~~there is contamination reported in the vadose zone from routine~~of geophysical monitoring between tanks C-105 and C-104 which identified contamination in the vadose zone. Contamination was noted in the soil around drywell 30-05-07 when it was drilled in 1974. Spectral gamma measurement shows a definite Cs^{137} peak between 34 to 44 ft below grade. Based upon this data tank C-105 was classified as an assumed leaker, but the data is not definitive. RPP-ASMT-46452, *Tank 241-C-105 Leak Assessment Completion Report* ~~the document~~ states that if C-105 did leak it was prior to 1974 and that the leak appeared to seal afterwards since the tank was used repeatedly until 1978 as an active receipt and feed tank. A small Cs^{137} peak is seen in adjacent drywell 30-05-05 between 60 and 65 ft below grade and a very small Cs^{137} peak in adjacent drywell 30-05-08 at 47 ft below grade.

2.4.2.1. Proposed Revision or Qualification to Assumed Leaker Status

RPP-ASMT-46452~~, *Tank 241-C-105 Leak Assessment Completion Report,*~~ concluded~~d~~s that a leak from the tank C-105 could not be ruled out~~. The~~and tank status summary report HNF-EP-0182 Rev. ~~28~~2334 ~~states in footnote 13 to Table 4-3 that the leak integrity status be revised to~~identifies tank C-105 as "~~Assumed~~ assumed ~~Leaker~~leaker" with an estimated leak volume ~~<~~ of approximately 2,000 gallons.

2.5 TANK WASTE VOLUME/CHARACTERISTICS

The waste volume and physical properties of the waste currently stored in tanks C-101 and C-105 and awaiting retrieval are summarized in Table 2-3.

The tank waste inventory data, including uncertainty, extracted from the best-basis inventory (BBI) (http://twinsweb.pnl.gov/twins.htm) is provided in Appendix C (Tables C-1 and C-2 for tanks C-101 and C-105 respectively). There are varying degrees of uncertainty associated with the waste inventory. The inventory uncertainty is a combination of the uncertainty associated with measurements of waste volume and concentration. Inventory uncertainty estimates have been completed for some but not all constituents and for some but not all waste types. The standard deviation is calculated from the variation in the sample analysis results. Details on the methodology used for developing inventory uncertainty values reported in the BBI are provided in RPP-7625, *Best Basis Inventory Process Requirements*. The inventory uncertainty data associated with contaminants that drive long-term risk (e.g., technetium-99) can be used for tanks C-101 and C-105 to provide insight to the uncertainty in long-term human health risks presented in Section 7.0. Indicator contaminants identified in Section 7.1.1.1 are noted in Tables D-1 and D-2.

Table 2-3. Waste Volume and Physical Properties Summary.

Waste Property	Unit	Tank C-101	Tank C-105
Solids volume [a]	gal.	88,000	132,000
Supernate volume [a]	gal.	0	0
Interstitial liquid volume [a]	gal.	4,000	10,000
Sludge density [b]	kg/L	1.78	1.55
Sludge percent water [b]	%	23.4	28.3

[a] HNF-EP-0182, 2005, *Waste Tank Summary Report for Month Ending March 31, 2005*, Rev. 204.

[b] Source: Best-basis inventory download from http://twinsweb.pnl.gov/twins.htm dated June 10, 2005.

Although there are uncertainties associated with contaminant inventories in the tanks (Appendix C, Tables C-1 and C-2), the following items show that there is sufficient information on the characteristics that affect waste retrieval, transfer, and storage in the double-shell tanks (DSTs) to proceed with waste retrieval. The information used for waste volumes and constituents is the best available and is deemed sufficient based upon knowledge of those attributes necessary for planning and design purposes to proceed with the retrieval.

- DOE (2003), *Dangerous Waste Permit Application—Single-Shell Tank System* (Part A Permit) list of constituents contains constituents not found in the BBI because of 'protective filing.' The constituents listed in the BBI (25 chemicals and 46 radionuclides) account for approximately 99 wt% of the chemical inventory (not including water and hydroxide) and over 99% of the activity in terms of short- and long-term risk, based on estimates developed using the Hanford Defined Waste (HDW) Model (RPP-19822, *Hanford Defined Waste Model – Revision 5.0).*

- ~~The above meets the requirements in Section 2.1.3 of Appendix I of the HFFACO that requires those contaminants accounting for at least 95% of the impact to groundwater risk be addressed.~~

- The BBI is the best available data; however, the Part A Permit provides a list of constituents that may or may not be present in the SSTs. To address this uncertainty, a post-retrieval sample will be taken of the residual waste for all constituents identified in the Ecology-approved sampling and analysis plan, pursuant to the requirements of that sampling and analysis plan.

There are currently no plans to perform additional characterization (e.g., sampling and analyses) of the waste in tanks C-101 or C-105 to support waste retrieval and transfer. Sampling and analysis activities associated with component closure actions will be performed in accordance with RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*, and RPP-PLAN-23827, *Sampling and Analysis Plan for Single-Shell Tanks Component Closure*." The

3.0 PLANNED WASTE RETRIEVAL TECHNOLOGY

This section provides a description of the primary and secondary waste retrieval technologies for retrieving the waste from tanks C-101 and C-105. The rationale for selection of primary and secondary technologies is provided in Section 3.3. However, in accordance with Appendix C, Part 1 of the Consent Decree:

> "If 360 cubic feet is reached with the first retrieval technology, the first retrieval technology shall be used to the "limits of technology" and a second retrieval technology shall not be required."

The primary technology is the first technology deployed for waste retrieval.

The primary technology for C-101 will be modified sluicing with an extended reach sluicer (ERSS). If required to meet the tank residual waste conditions in the Consent Decree, the second technology for C-101 will be high pressure water deployed with the ERSS.

The primary technology for C-105 will be venturi vacuum with supernate or water. The second technology will be high-pressure water spray. Both of these technologies will be deployed via MARS-V. The MARS-V is designed to implement both the primary and secondary technology when needed. The third technology for C-105 is chemical dissolution using an ERSS sluicing system.

Retrieval activities will switch from one technology to the other as required to reach the Consent Decree residual waste goal.

In accordance with the Consent Decree, Appendix C, Part 1:

> "If the waste residual goal of 360 cubic feet is not achieved using the two technologies, an additional retrieval technology established in a revised TWRWP shall be deployed to the "limits of technology;" provided that DOE may request that the State agree that DOE may forego implementing a third retrieval technology if DOE believes implementing such technology is not practicable under the criteria set forth above [in Appendix C, Part 1 of Decree]. If DOE and Ecology are unable to reach agreement, the resolution of the issue of whether a third retrieval technology shall be deployed shall be resolved through the dispute resolution process set forth in Section IX of this Decree."

3.1 SYSTEM DESCRIPTION

This section provides a description of the waste retrieval system (WRS) and how each will be operated. Continued design development and incorporation of lessons learned may lead to changes in the design and/or operating strategy.

3.1.1 Waste Retrieval System Physical System Description

For tank C-101 the physical equipment will consist of a modified sludge sluicing system to mobilize and retrieve waste. The sluicing system will include two (or more) sluice nozzles and a slurry pump in the tank. The sluice nozzles will be controlled from a control trailer located outside the tank farm fence. The sluice nozzles can be installed in existing tank risers located around the perimeter of the tank. The sluice nozzles will have the capability to direct liquid at various locations in the tank. Double-shell tank supernate will be used as the primary sluicing liquid. The WRS will also have the capacity to use raw water for sluicing with minor modifications and has high pressure water to break apart hard agglomerations of waste. The flow rate through the sluice nozzles will be adjusted based on the pump-out rate so that the rate of liquid introduction will approximately equal the rate of solution removal with the objective of minimizing the liquid waste volume in the retrieval tank.

The WRS for tank C-105 will be the MARS-V. The MARS-V mobilizing process consists of an extendable robotic arm suspended from a large central riser added to the tank and serves as the deployment platform for two separate retrieval technologies. For one technology, the end of the arm is equipped with nozzles that direct supernate and/or water onto the waste surface from a short distance away and vacuums the mobilized waste slurry backwards to a slurry pump. A second technology provided by the MARS arm is the addition of high pressure water spray nozzles that serve to break up hard waste agglomerations and direct them to the slurry pump. The slurry pump may use a backstop that can capture the slurry waste and is equipped with more supernate and water nozzles to further break the waste up for removal by the pump.

When chemical dissolution retrieval is needed in tank C-105, the MARS-V arm will be removed and a slurry pump will be installed along with sluicing nozzles that can add and re-circulate dissolution liquid. The sluicing system will be similar to the system described above for tank C-101.

The waste retrieved from tanks C-101 and C-105 will be transferred to a DST. To minimize the overall volume of waste requiring storage in the DST system, the waste retrieval project plans to use DST supernate as the primary sluice/mobilizing liquid (see Section 3.1.3 for operating description). The WRS will also have the capability to use raw water for sluicing with valving change or minor modifications.

The waste retrieval plan as of December 2011 for using DSTs for waste receipt and as source tanks for supernate recycle is shown in Figure 3-1. The DSTs were selected based on their location, available space, and existing or planned equipment upgrades. Additional detail on the planned use of supernate during waste retrieval is discussed in Section 3.2.

The MARS-V uses several different processes to remove waste from the tank. For the first methodology, several nozzles on the end-effector are used to mobilize (dissolve or suspend waste in the mobilizing fluid) waste and vacuum it to the waste accumulator tank. These nozzles normally use supernate for waste mobilization. A second methodology uses additional nozzles on the end-effector to supply high pressure water to break up hardened waste aggregations from a short distance away. The broken pieces are then mobilized and vacuumed up with the eductor to the waste accumulator tank and from there pumped to the DST with the slurry pump.

The MARS-V is equipped with a sensing system that detects back pressure when the arm bumps into a tank wall or bottom, and halts motion of the arm in that direction before excessive pressure is exerted. This is expected to minimize damage to the arm (or the tank wall/bottom). Visual monitoring of the MARS-V head will also minimize bumping of the MARS-V head into the tank wall or bottom. The sensor will be operable prior to insertion of the MARS-V into the tank, but it is not planned to remove the arm to repair the sensor should it fail after the MARS-V is installed.

The MARS-V is operated from a control trailer outside the tank farm.

Table 3-2 provides the projected riser usage for the tank C-105 WRS. The WRS design for tank C-105 has not been completed; therefore, the riser usage for this tank can only be projected at this time. Volumes associated with tanks C-105 retrieval have been evaluated and are provided in the flowsheet RPP-21753, *C Farm 100-Series Tanks, Retrieval Process Flowsheet Description.*

Table 3-2. Projected Riser Usage for Tank C-105.

Riser Number	Tank C-105
R1	Not used
R2	Camera ~~and ventilation exhaust~~/lights, ~~duct~~caustic addition/sampling sleeve
R3	~~Not used~~Sluicer box
R4	Not used
R5	Not used
R6	~~Not used~~Sluicer box
R7	~~Camera and breather filter~~Abandoned pump
R8	~~ENRAF* level gauge~~Camera/lights
R9	TBD
New 13	MARS
Condenser pit	TBD

* Enraf is the supplier of the identified level gauges; ENRAF is a trademark of Enraf, Inc., Enraf B.V., Delft, The Netherlands.

Structural evaluations will be performed evaluating the tank dome loading conditions resulting from cutting the hole into C-105 and adding the large riser for support of the MARS equipment, and monitoring/evaluation will be performed during the riser installation process. The pre-cut evaluations are RPP-CALC-49671 *Calculation Package for the Installation of a Large Riser on Tank 241-C-105* and RPP-CALC-51195, *An Evaluation of Single-Shell Tank 241-C-105 for the Addition of a Large Penetration in the Tank Dome.* These pre-cut evaluations show the structural integrity of the tank dome will be maintained following the installation of the large riser.

An independent, qualified registered professional engineer (IQRPE) report will be prepared and issued for the large riser installation. This report will be separate from the IQRPE report for the MARS retrieval equipment. See Section 3.8 for clarifying words on WAC compliance.

3.1.2 Double-Shell Receiver Tanks

The planning includes using tank AN-101 as the receiver tank for waste retrieved from tanks C-C-101. Waste retrieved from C-105 will be sent to AN-106. Ongoing evaluations may result in identifying alternate receiver tank(s).

A slurry distributor was installed in AN-101 as part of the C-104 waste retrieval project. A new slurry distributor and pump was installed in AN-106 to support retrievals with AN-106 supernate.

Because the elevation of the AN tank farm is approximately 22 ft higher than the C tank farm the slurry distributor and the supernate pump incorporate anti-siphon devices to prevent unintentional flow from the DST to the SST.

All waste transfers, including transfer of waste from the C farm tanks to the DSTs and the transfer of supernate from DSTs back to the WRS vessel/pump skid above the C farm tanks, will be performed using transfer lines that provide secondary containment. The waste retrieval project currently plans to use overground hose-in-hose transfer lines (HIHTLs) and the *Resource Conservation and Recovery Act of 1976* (RCRA)-compliant DST transfer system.

3.1.3 Waste Retrieval System Operating Description

The overall WRS operating strategy will consist of reducing the SST waste inventories. The process will be monitored using closed-circuit television to facilitate waste retrieval and minimize any liquids in the tanks. Supernate will be used as the primary retrieval liquid. Raw water will be used in limited quantities as necessary for waste conveyance and transfer line flushing.

During routine modified sluicing operations in tank C-101, waste retrieval will be initiated by starting the supernate pump in the DST source tank and using the pumped supernate to provide sluicing fluid to the selected sluice nozzle. Initial sluicing will be focused in the center portion of the tank to minimize the time required to get liquid to the slurry pump to allow it to be started. The in-tank camera will be used to provide visual input for directing the sluice nozzle. The slurry pump in tank C-101 will be started as soon as liquid from the sluicer operation reaches the area of the pump inlet and there is enough liquid present to prime and operate the pump. During waste retrieval, the flow of liquid into the tanks through the sluice nozzles will be controlled to both limit accumulation of liquid in the tank and to maximize waste retrieval efficiency. The slurry removed will consist of both mobilized tank waste and DST supernate used for mobilization. Maintaining a balanced pumping rate into and out of the tanks is integral to minimizing the liquid volume in the tanks and reducing the potential for leakage.

When the tank C-105 ERSS sluicing or high pressure nozzles are used prior to adding sodium hydroxide (caustic), waste retrieval will be initiated by starting the supernate pump in the DST source tank and using the pumped supernate to provide sluicing fluid to the selected sluice nozzle. Initial sluicing will be focused in the center portion of the tank to minimize the time required to get liquid to the slurry pump to allow it to be started. The in-tank camera will be used to provide visual input for directing the sluice nozzle. The slurry pump in tank C-105 will be started as soon as liquid from the sluicer operation reaches the area of the pump inlet and there is enough liquid present to prime and operate the pump. During waste retrieval, the flow of liquid into the tanks through the sluice nozzles will be controlled to both limit accumulation of liquid in the tank and to maximize waste retrieval efficiency. The slurry removed will consist of both mobilized tank waste and DST supernate used for mobilization. Maintaining a balanced pumping rate into and out of the tanks is integral to minimizing the liquid volume in the tanks and reducing the potential for leakage.

Pumping during mixing/sluicing will maintain minimum liquid volume in the tanks. This will be performed by initially directing the nozzle flow towards the center of the tanks. As the sluice liquid contacts the tank waste, the sludge will be mobilized and retrieved via the slurry pumps. Typically, one sluicer will be operated at a time operating at a flow rate of approximately 60 to 120 gal/min."

Liquid will not be purposely sprayed at the walls to avoid exposing a plugged leak site if it exists. After the majority of the waste is removed, wall washing with supernate or water will be considered if additional waste needs to be removed from the tank.

Dissolution rates and effectiveness depend on the mixing. During dissolution, the slurry pump will pump liquid from the caustic pool up to the valve box and back through the ERSS sluice nozzles into C-105 to mix the liquid in the tank.

Pumping during sluicing will maintain minimum liquid volume in the tanks. This will be performed by initially directing the nozzle flow towards the center of the tanks. As the sluice liquid contacts the tank waste, the sludge will be mobilized and retrieved via the slurry pumps. Typically, one sluicer will be operated at a time operating at a flow rate of approximately 60 to 120 gal/min.

An additional technology provided by the ERSS is the capability to add high pressure water to break up particles that resist breakup or mobilization with the lower pressure supernate (or water) stream. High pressure water could be used at any time during the retrieval process but it is not envisioned that much will be needed until towards the end of retrieval.

At these meetings, ORP will provide to Ecology the basis and rationale for continuing retrieval when it is suspected that waste form behavior, tank condition and/or equipment performance has diminished significantly or performance impacted the ability of the deployed equipment to operate in order to meet the waste residual goal of 360 ft^3.

Ecology is notified in the Tri-Party Agreement project manager's monthly meeting when it appears that the limits of technology have been reached. Status reports are continued until waste retrieval operations cease. An SST waste retrieval evaluation form and a retrieval report are then prepared and issued and in accordance with the Consent Decree Part IV, B.5:

> "When DOE completes retrieval of waste from a tank covered by this Decree, DOE will submit to Ecology a written certification that DOE has completed retrieval of that tank. For purposes of this Consent Decree, "complete retrieval" means the retrieval of tank waste in accordance with Part 1 of Appendix C and with the retrieval technology/systems that were established by Part 1 of the TWRWP either by approval of Ecology or after dispute resolution by the Court under Section IX of the Decree."

Following completion of waste retrieval and final tank flushing, the residual waste volume will be determined using the methodology defined in RPP-23403, *Single-Shell Tank Component Closure Data Quality Objectives*, and RPP-PLAN-23827, *Sampling and Analysis Plan for Single-Shell Tanks Component Closure.*

3.1.4 Chemical Dissolution Process

Chemical dissolution process details are contained in the process control plan for each tank in which a chemical dissolution process is used. When samples are available, the retrieval process is tested on hard heel samples of tank waste prior to deploying the retrieval technology. If hard heel samples are not obtained, the hard heel composition is deduced from tank historical data. The hard heel volume to be treated is normally not known until bulk retrieval is complete. To minimize the volume of caustic needed, sluicing and high pressure water are used to remove the majority of the insoluble waste. The hard heel volume can be determined from visual observation, level sensors, or liquid displacement using tank level sensors. The composition and volume of the heel are used to confirm the quantity and type of chemicals used for chemical dissolution process.

The chemical dissolution process may consist of a series of steps or be a single action depending on how the waste reacts to the process. If a single step will dissolve sufficient solids to achieve the volume reduction mandated by the Consent Decree, only one chemical dissolution process step will be deployed. The chemical dissolution process may include one or more of the following:

- supernate sluicing to remove compounds insoluble in the caustic liquids found in the tanks,
- high pressure water shattering of agglomerates to increase surface area available for chemical attack, and

- high molarity caustic solution to break down aluminum hydroxide compounds.

Ecology will be informed of the pre-retrieval estimated volume of liquid(s) to be added to the tank prior to the initial addition(s). Water additions for dissolution and volume reduction associated with a chemical retrieval process are separate actions from the heel rinse described in section 3.2.

Unlike modified sluicing, there is no operational data available that can be used to estimate the recovery rate for a limit of technology determination for the chemical dissolution process planned for C-105. If the first step of a multiple step dissolution achieves the Consent Decree waste residual goal, the limit of technology will be considered to have been met for the chemical dissolution process technology. Using unnecessary chemical dissolution process steps adds risk to worker safety and has retrieval schedule impacts, DST storage volume impacts, and thus possible mission impacts.

If the Consent Decree waste residual goal is not achieved, and all steps of the chemical dissolution process have been deployed as specified in the process control plan, the limit of technology will be considered to have been met for the chemical retrieval dissolution provided the data shows that additional chemical dissolution process steps are not practicable. If the Consent Decree waste residual goal is achieved without deploying all of the dissolution steps specified in the process control plan, ORP will evaluate the benefit of continued retrieval and inform Ecology of the results in normally scheduled meetings as described in Section 3.1.3.

If third technology retrieval operations are interrupted due to an unexplained anomalous condition indicating a leak, the actions described in section 4.6 will be taken. If a leak is confirmed, a practicability evaluation will be performed and revised operating strategies will be considered to determine whether it is impracticable to continue to pursue a third retrieval technology even though the evaluation was not triggered by a reduction in recovery rate.

3.2 LIQUID ADDITIONS DURING WASTE RETRIEVAL

For tank C-101, the pump adjustment features described previously should allow the tank C-101 pump to be installed with little or no water addition However, if tank conditions require water additions to successfully install the pump (e.g., debris under the pump installation riser), water additions would be controlled in accordance with OSD-T-151-00013, *Operating Specifications for Single-Shell Waste Storage Tanks*, This water would be added through one or both of the sluicers, by lancing, or by back flushing through the pump.

The MARS-V installation into tank C-105 is not anticipated to require any water addition beyond the riser cutting slurry. The waste accumulator tank will be above the waste level so it should not be necessary to move any material to install the MARS-V. However, if tank conditions require water additions to successfully install the MARS-V (e.g., debris under the pump installation riser), water additions would be controlled in accordance with OSD-T-151-00013, *Operating Specifications for Single-Shell Waste Storage Tanks*,

Water could also be added to the tank as needed to flush equipment removed from the tank or for a number of operational reasons. The use of water is minimized to avoid taking up DST storage

When adding liquid to the SST for the sole purpose of obtaining a waste level measurement, the following conditions apply:

- The HRR leak detection system for the tank described in Section 4.2.1 must be continuously operable for at least 48 hours prior to the liquid addition.
- The benchmark level described in Section 4.6.1 will not be exceeded during the liquid addition.
- Excess liquid will be removed from the tank as soon as practical once a usable waste level measurement is obtained.
- The liquid to be used for volume displacement measurement should only be supernate. Use of raw water for volume displacement instead of or in addition to supernate shall be discussed with Ecology prior to use.

At the cessation of waste retrieval operations, the tank walls and heel will be flushed with water to the extent practical ~~with water~~. Flush water will not be purposely sprayed on the walls above the maximum level stated in the process control plan for C-105. Supernate or high pressure water may be used to remove solids above 54 inches in C-101 provided no hole in the steel liner is observed and no prolonged spray is directed at any location. Spray may not be directed higher than one foot below the top of the steel liner to avoid inadvertently spraying the dome directly or liner cap. When performing the tank flushes, the flush water may be used to push some of the residual waste to a convenient sampling location. For each flush, the volume of water added will be metered and recorded. The flush liquid will be pumped to a minimum heel following each flush addition. It is assumed that performing the final tank flushes will remove residual solids to the extent practical on the walls, dilute soluble radionuclides and chemicals in the tank liquid, and may dissolve potentially soluble compounds that are insoluble in the higher molarity caustic solutions normally present in the tank. The ENRAF level gauge readings taken during the flushing will provide backup data that can be used to support the final tank residual waste measurement.

The timing for transfers out of tank C-101 and C-105 is dependent on personnel resource availability, equipment availability, and DST conditions. Once waste retrieval is started, it should follow the general pattern described, but no liquid additions or removals to/from tanks C-101 and C-105 can be predicted for more than a day or two in advance; therefore, no detailed timeline can be developed showing all liquid additions and removals. The water or supernate addition/removal may be intermittent or continuous. Based on experience with other modified sluicing and saltcake dissolution retrievals, it will likely last for an 8- to 16-hr period, then be followed by a one shift to several days wait, then continue. Work continuity will be dependent on resource availability. Ideally the retrieval will be completed within a few months, but delays with tank farm work and lack of available resources could increase retrieval duration.

During C-105 retreival with the MARS-V liquid will be removed as practical from the local depression created by the end effector, and as the depression gets deeper the volume of interstitial liquid in the tank will decrease. Minimizing the interstitial liquid is achieved by minimizing free liquid in the depressions to the extent practical during retrieval. The volume of

Waste Retrieval from Single-Shell Tanks (SST) 241-C-103 and 241-C-105). Based on the available information, Ecology will not approve the use of modified sluicing without additional data defining the source of the vadose zone contamination near tank C-105. Following discussions with Ecology, the MARS-V was selected to minimize the potential leakage volumes that might occur during waste retrieval.

The second technology alternatives, should one be required for residual waste removal following modified sluicing, are an in-tank vehicle, high pressure water, and a chemical retrieval process.

Generally, an in-tank vehicle is desirable for large or monolithic particles since it can break these up for sluicing, while a chemical retrieval of larger aggregates may be slow or ineffective due to the small surface area for dissolution. High pressure water or an in-tank vehicle is preferred as the heel volume increases because a chemical retrieval process may take up too much DST space and, for caustic or acid dissolutions, will have proportionally more impact to the DST space. A chemical retrieval process is preferable for heels where the volume is relatively low so the impact on DST space and the WTP throughput volume is less. A chemical retrieval process may also be preferable if the particles are small because the surface area for dissolution is greater and an in-tank vehicle may just push the fine particles around the tank.

High pressure water was selected as the second technology for C-101 as it can be deployed in less time than an in-tank vehicle or chemical dissolution and because it is believed the estimated residual heel volume could be reduced to below 360 ft^3 without causing a significant impact to the available DST space or the WTP throughput volume.

Second technology selection inherently relies on past experience and assumptions on the tank waste characteristics that will be present after the first technology is deployed to its limits. Recent experience with tank C-107 has shown that high pressure water is effective in concert with sluicing retrieval operations.

The primary and second technologies selected are anticipated to provide the best methods to achieve the 360 cubic feet target volume goal specified in the Consent Decree, when deployed to their "limits of technology." The "limits of technology" as defined in the Consent Decree is noted in section 3.1.3.

Third technology alternatives are considered if the selected first and second technologies do not achieve the Consent Decree waste residual goal and it is practical to deploy a third retrieval technology. The rationale provided for the selection of the first two tank C-105 retrieval technologies was written prior to field deployment of those technologies and is maintained in this TWRWP for historical record. This third technology rationale is described below.

The MARS-V retrieval system was only able to retrieve about 45% of the waste in tank C-105. Even though retrieval goals were not met, the retrieval system operated as designed with a few operational adjustments. The arm function operated well and moved the end effector in close proximity to the waste. The vacuum was strong and the system operated for approximately 1,500 hours before a critical hose failure disabled the system. The waste was more viscous and had more agglomerates than anticipated and the mobilizing supernate was nearly saturated with phosphate. The waste picked up by the vacuum eductor plugged the nozzle. When high pressure water was used to mobilize the waste, the system was more effective.

External tank leak detection monitoring has been conducted with the high resolution resistivity (HRR) system and moisture logging since January 2013. Except during power outages and to protect the system from lightning, the HRR has operated continuously since 5/19/14. There has been no indication of a leak from the tank. Gamma scans are planned before deploying a third technology to provide additional assurance that retrieval actions have not caused a leak.

A Systems Evaluation Engineering (SEE) team was assembled in October of 2014 in order to recommend options to improve retrieval rates. Enhanced operational strategies improved retrieval performance so no system changes were warranted until a hose failure disabled the system. The failed hose could be replaced, but due to the high number of operating hours on the entire system, there is an increased likelihood of additional component failure. A SEE team was re-assembled to recommend options for tank C-105 retrieval. RPP-RPT-58422, *241-C-105 Completion Systems Engineering Evaluation,* documents the SEE evaluation process and results.

In general terms, the SEE team considered two options for tank C-105 retrieval; 1) enhancement and repair of the MARS-V, and 2) installation of a sluicing system. Even if the hose were repaired and the MARS-V system were enhanced to better retrieve the type of waste encountered in tank C-105, other system components are aged and have an increased probability of failure. Also, the MARS-V design does not include a slurry pump that can be raised and lowered into the waste in the tank, so recirculating caustic would be difficult. The evaluation concluded that installation of a sluicing system that would be able to deploy chemical dissolution with caustic was most favorable. Sluicing systems have been used successfully in many tanks and with many types of waste. The sluicers can be used to recirculate added chemicals and the ERSSs can be maneuvered close to hard waste agglomerations that are difficult to break apart. There has been no indication of a leak in tank C-105 and the current leak detection system and operation can be enhanced to increase the probability of detecting a leak.

The waste in tank C-105 contains a high percentage of aluminum relative to other waste components which is readily dissolved by caustic. Caustic is also effective at dissolving phosphate solids and organic materials. If organic binders are present in the waste, sodium hydroxide may dissolve the binders reducing the size of agglomerations. Laboratory testing has shown that the waste in tank C-105 is amenable to caustic dissolution.

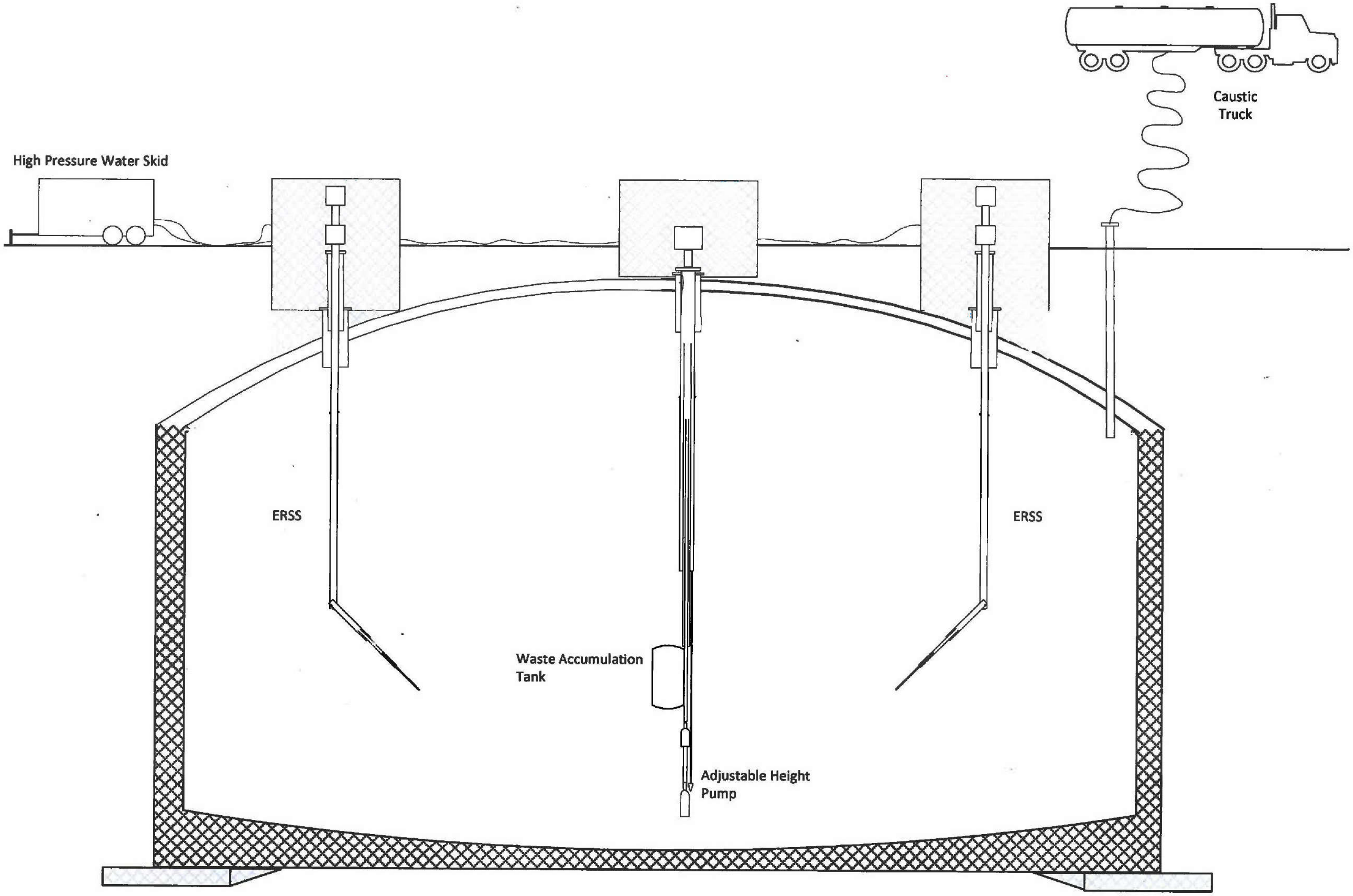
3.4 ANTICIPATED PERFORMANCE GOALS

The retrieval technology equipment selected for tanks C-101 and C-105 will be designed, deployed, and operated to each of their limits of technology, as defined in this document, in an effort to obtain a waste ~~residue~~ residual goal of 360 cubic feet of waste or less for each tank in accordance with the Consent Decree.

3.5 WASTE RETRIEVAL SYSTEM DIAGRAM

Diagrams of the C-101 and C-105 WRS in-tank components are provided in Figures 3-2 and. 3-3. A plan view showing the abovegrade skid locations are provided in Figures 3-4 and 3-5. As noted in Section 3.1.2, the elevation in the AN tank farm is approximately 22 ft. higher than the elevation in the C tank farm.

Figure 3-3: Tank C-105 Third Technology Waste Retrieval System In-Tank Components



241-C-105 with ERSS

Table 3-5. Tanks C-101 and C-105 Waste Retrieval System Functions and Requirements. (2 Sheets)

Function	Requirement	Basis*	Key Elements
Control gaseous and particulate discharges	The ventilation system exhaust shall be filtered to restrict emissions to the environment.	WAC 173-303 WAC 173-400 WAC 173-460 WAC 246-247 TFC-ESHQ-ENV-STD-03 TFC-ESHQ-ENV-STD-04	Mitigate potential release to the public and the environment.
Mitigate potential for leaks to occur during waste retrieval	Prevent inadvertent release from tank C-101or C-105 to the environment.	RPP-13033, Section 3.3.2.3.4	Do not raise waste level above benchmark level. Benchmark level to be provided in process control plan.
Control waste level in tanks C-101 and C-105	The WRS shall be operated to prevent waste level from exceeding 185 in.	OSD-T-151-00013	Minimize liquid level to the extent practical.
Control waste level in DST receiver tank	The WRS shall be operated to maintain waste level within specified allowable maximum and minimum values.	OSD-T-151-0007	Provide for safe waste storage in DSTs.
Remove waste from tanks C-101 and C-105	The retrieval technologies will be designed, deployed, and operated to each of their "limits of technology" in an effort to achieve the waste ~~residue~~ residual goal of 360 ft^3 of waste or less for each tank. The limit of technology is defined in the Decree.	WAC 173-303 Consent Decree	The retrieval technologies shall have the potential to achieve a waste ~~residue~~ residual goal of 360 ft^3 or less.
Control and monitor the waste removal process in tanks C-101 and C-105	The WRS shall provide the monitor and control capability to control the waste retrieval and transfer process. This includes controlling and monitoring the following WRS process parameters: • Pressures • Flow rates • Differential pressures across exhaust ventilation filters • Leak detection systems.	RPP-13033 HNF-SD-WM-TSR-006 WAC 173-303 WAC 246-247 TFC-ENG-STD-26	Provide for safe and effective operation of the WRS.
Minimize waste generation	The WRS shall minimize waste generation to the greatest extent practical.	WAC 173-303 40 CFR 264.73(b)(9)	No numerical requirement.

4.0 DESCRIPTION OF PLANNED LEAK DETECTION AND MONITORING TECHNOLOGIES

NOTE: Section 4 on leak detection was revised in RPP-22520 Rev 5 to make it consistent with the Section 4 wording in RPP-33116, *241-C-110 Tank Waste Retrieval Work Plan*, Rev 2, which was approved by Ecology on July 3, 2008. The italicized wording at the start of most subsections is provided for consistency with the required subsection contents in RPP-33116; however, the Consent Decree now establishes the requirements for TWRWP content.

4.1 EXISTING TANK LEAK MONITORING

This section describes tank leak monitoring activities that have been historically performed or are currently being performed.

Prior to beginning retrieval operations, single-shell tanks are in waste storage mode. The requirements for leak detection while in waste storage mode are provided in OSD-T-151-00031, *Operating Specifications for Tank Farm Leak Detection and Single-Shell Tank Intrusion Detection.* When retrieval operations are ready to commence for C-101 or C-105 the tanks enter retrieval mode as described in 4.2.

4.1.1 Drywell Monitoring

Identify the number and location of drywells near the subject tank. Identify ongoing routine drywell monitoring activities. (configuration, depth, frequency of and methodology for sampling)

There are six drywells spaced around tank C-101 that are between 2 and 20 ft from the edge of the tank (Figure 4-1). The six drywells include 30-01-01, 30-01-06, 30-00-06, 30-01-09, 30-04-05, and 30-01-12. Five of the drywells are 100 ft deep. One drywell (30-00-06) is drilled to 150 ft deep but can only be logged to 111 ft because of grouting (GJ-HAN-85, *Vadose Zone Characterization Project at the Hanford Site Tank Farms Tank Summary Data Report for Tank C-101*).

Ten drywells are spaced around tank C-105 that are between 2 and 12 ft from the edge of the tank (Figure 4-1). The ten drywells include 30-05-02, 30-05-03, 30-05-04, 30-05-05, 30-05-06, 30-05-07, 30-04-02, 30-05-08, 30-05-09 and 30-05-10. Three of the drywells are between 50 and 70 ft deep, 3 drywells are 100 ft deep, and 4 are between 120 and 135 ft deep (GJ-HAN-83, *Vadose Zone Characterization Project at the Hanford Tank Farms Tank Summary Data Report for Tank C-105*).

For tanks in waste storage mode there is no routine drywell logging performed.

4.1.2 Groundwater Monitoring

Identify the number and location of groundwater monitoring wells associated with the Waste Management Areas (WMA). Summarize current groundwater monitoring activities.

Additional monitoring wells have been added since 1989. A current list of the WMA C groundwater monitoring wells can be found in DOE/RL-2009-77. The wells are sampled quarterly to meet prior agreements made with Ecology. Quarterly samples are analyzed at a minimum for anions, cyanide, inductively coupled plasma metals, gross beta, technetium, and total uranium, and a low-level gamma scan is performed. Sampling is conducted in accordance with DOE/RL-2009-77 and DOE/RL-2001-49.

The quarterly groundwater monitoring that is currently performed is adequate for the purpose of supplementary data collection during waste retrieval. Ecology is provided quarterly groundwater monitoring sample results in the quarterly and annual groundwater monitoring reports. These reports are issued by the groundwater project.

If a leak is detected during retrieval, groundwater monitoring frequency will be reevaluated in accordance with the regulatory requirements in WAC 173-303, "Dangerous Waste Regulations."

4.1.2.1 Use of Groundwater Monitoring for Retrieval Process Control.

(1) *Evaluate the use of appropriately located existing groundwater monitoring wells for retrieval process control.*

Based on the limitations of flow transport calculations and the time required for a retrieval leak to show up in groundwater samples, groundwater monitoring data will not be used for retrieval process control, but is available, for background reference information only, through the site groundwater monitoring program.

4.1.2.2 Groundwater Sampling Prior to and Following Retrieval.

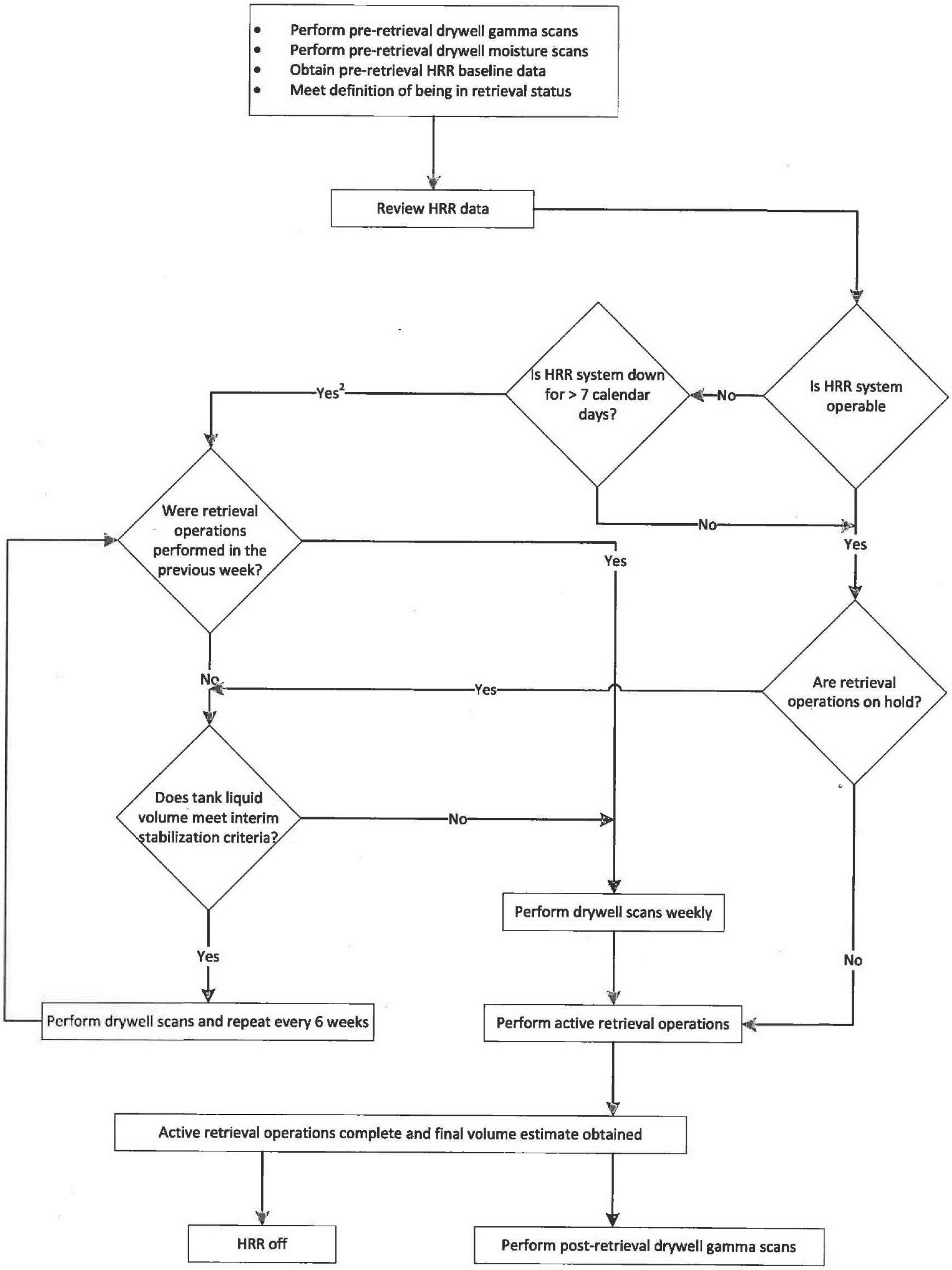
(2) *Ensure that appropriately located existing groundwater monitoring wells will be sampled within a two month period prior to and following the retrieval (quarterly sampling satisfies this requirement).*

Quarterly groundwater sampling is performed for the C-farm groundwater monitoring wells. In accordance with 04-TPD-083, "*Agreement on Content of Tank Waste Retrieval Work Plans*" (04-TPD-083 – letter), it was agreed to in writing by ORP, Ecology, and the tank farm contractor that quarterly groundwater sampling satisfies the TWRWP outline requirement C.1.b.(2) (this wording is in italics at the start of Section 4.1.2.2) to take groundwater samples within a 2-month period prior to and following retrieval.

4.1.3 Existing Tank Level Monitoring Equipment and Activities

Identify existing level measurement instrumentation in the subject tank and receiver tank. Identify ongoing tank level monitoring activities.

Figure 4-3. Leak Detection Methodology for SST Retrieval.[1]



[1]Leak detection using SST level measurement may supersede HRR and drywell monitoring when criteria 4.2.1.2 are met.
[2]Only until HRR is back in service.

4.2.1.1. Drywell Monitoring. Drywell monitoring refers to use of moisture gauges and/or gross gamma detectors to monitor soil conditions surrounding the tank for increases in moisture content and/or gamma activity that may be evidence of tank leakage. Drywell logging will be performed as follows:

- Gamma scans will be obtained for each listed drywell prior to initiation of retrieval operations in the tank. Gamma scans will be obtained for each of the tank C-105 listed drywells prior to third technology deployment.
- Moisture scans will be obtained for each listed drywell prior to initiation of retrieval operations in the tank
- After retrieval operations have been initiated drywell logging will only be performed if needed as a backup leak detection method.
- Gamma scans will be obtained for each listed drywell following completion of active retrieval operations in the tank

Should a pre-retrieval gamma scan show an unexpected presence of radioactivity in the soil adjacent to any of the listed drywells, and the unexpected reading is confirmed, the tank leak assessment process in procedure TFC-ENG-CHEM-D-42 would be implemented. Retrieval activities as described in this work plan would not commence until the unexpected reading had been evaluated and shown to not alter the leak status stated in 2.4 for the tank whose waste was to be retrieved.

Current plans include monitoring of the following drywells prior to waste retrieval:

- **Tank C-101** – 30-01-01, 30-01-06, 30-00-06, 30-01-09, 30-04-05, and 30-01-12
- **Tank C-105** – 30-05-02, 30-05-03, 30-05-04, 30-05-05, 30-05-06, 30-05-07, 30-04-02, 30-05-08, 30-05-09 and 30-05-10

There is a potential that access to some drywells may be precluded by the placement of equipment or shielding, restricted due to ALARA (as low as reasonably achievable) concerns, or alterations to the tank farm surface as a part of ongoing waste retrieval activities.

Some drywells may be double-cased with 8- and 12-in. casing, and/or have grout around them. This makes them unsuitable for moisture monitoring, (and of limited use for gross-gamma monitoring). If any of these drywells are double-cased or have grout around them they will not be moisture logged.

The pre- and post-retrieval gamma scans will be obtained from near the ground surface to near the bottom of each drywell. Pre-retrieval gamma scans will preferably be obtained within a year of retrieval start but may, with approval from Ecology, be within two years.

The pre-retrieval moisture scans will be obtained from near the ground surface to near the bottom of each drywell. Pre-retrieval moisture logging is performed to provide a baseline for comparison should moisture logging be required for backup leak detection during waste

5.0 REGULATORY REQUIREMENTS IN SUPPORT OF RETRIEVAL OPERATIONS

Retrieval of waste from the C-Farm SSTs will be performed under the requirements of the Consent Decree, *Atomic Energy Act of 1954*, RCRA, Chapter 70.105 RCW and its implementing regulations, and WAC 173-303. The SSTs do not provide secondary containment and are not compliant with RCRA and Chapter 70.105 RCW interim facility standards of Subpart J of 40 CFR 265. The SSTs are currently authorized to continue operations under the Chapter 70.105 RCW pending closure in accordance with WAC 173-303-610, *Closure and Post Closure*, under the authority of HFFACO Milestone M-45-00, *Complete Closure of all Single-Shell Tank Farms*. Except as otherwise modified by HFFACO Milestone M-45-00, DOE conducts day-to-day operations of the SSTs in accordance with the interim status facility standards established in WAC 173-303-400(3), "Interim Status Facility Standards." WAC 173-303-400(3) incorporates by reference the interim status performance standards set forth by the EPA in 40 CFR 265. Additionally, the SSTs are governed by federal regulations promulgated under the authority of the *Atomic Energy Act of 1954* and various DOE directives incorporated into the contract between ORP and the TOC (DE-AC27-0RV14800 for current TOC). These requirements are implemented through operating plans and procedures by the TOC.

Interim status facility standards in WAC 173-303-400(3)(a) incorporate, by reference, the interim status standards set forth by the EPA in 40 CFR 265 Subpart J for tank systems. Elements of the interim status standards relevant to the WRS along with the WRS features and/or operating plans and procedures are summarized in Table 5-1.

If necessary, DOE will seek approval from EPA to retrieve waste from tank C-105 using supernate from a receiver DST that could contain polychlorinated biphenyls, ~~from tanks C-101 and C-105 using supernate from the receiver DST~~ and transfer the resulting slurry to the respective receiver DST ~~from EPA~~ before initiating waste retrieval operations. DST supernate is classified as polychlorinated biphenyl remediation waste in accordance with Ecology et al. (2000), *Framework Agreement for Management of Polychlorinated Biphenyls (PCBs) in Hanford Tank Waste*. Because the DST supernate is polychlorinated biphenyl remediation waste, the retrieval of waste from SSTs, when using DST supernate, requires a Risk-Based Disposal Approval, approved by EPA, pursuant to the *Toxic Substances Control Act of 1976*.

Those components of the aboveground system using DST supernate to transfer SST waste to the receiving DST will be handled consistently with the current method of addressing polychlorinated biphenyl (PCB) waste in the DST system.

The ventilation system(s) used during waste retrieval operations are designed to pass air through the tank, thereby reducing condensation and fog within the tank. The ventilation systems required by Washington State Department of Health include a heater, prefilter, demister, two high-efficiency particulate air filters and test sections, exhaust fan, and stack. Details of the ventilation systems are provided in 00-05-006, *Hanford Site Air Operating Permit,* as amended and succeeded.

7.0 PRE-RETRIEVAL RISK ASSESSMENT

This section provides long-term human health risk information to support operational decisions in the event a leak is detected during waste retrieval operations for tanks C-101 and C-105. The need to consider long-term human health impacts in developing tank waste retrieval work plans was established in the HFFACO M-45 milestone series through Change Request M-45-04-01.

According to Appendix I of the HFFACO and the Decree, the information provided in the work plans will include the following:

> *A pre-retrieval risk assessment of potential residuals, consideration of past leaks, and potential leaks during retrieval, based on available data and the most sophisticated analysis available at the time. The purpose of this risk assessment is to aid operational decisions during retrieval activities. This risk assessment will not be used to make final* tank *retrieval or closure decisions. The risk assessment will contain the following as appropriate:*
>
> - *Long-term human health risk associated with potential leaks during retrieval and potential residual waste after completion of retrieval.*
>   - *Potential impacts to groundwater, including a ~~waste management area (~~WMA~~)~~-level risk assessment.*
>   - *Potential impacts based on an intruder scenario.*
> - *Process management responses to a leak during retrieval and estimated potential leak volume.*
> - *The pre-retrieval risk analysis will be based on the following criteria:*
>   - *Using the WMA fenceline for point of compliance.*
>   - *Identify the primary indicator contaminants (accounting for at least 95% of impact to groundwater risk) and provide the incremental lifetime cancer risk (ILCR) and hazard index (HI).*
>   - *Using ILCR and HI for the industrial and residential human scenarios as the risk metric.*
>   - *Calculated concentration(s) of primary indicator contaminant(s) in groundwater (mg/L and pCi/L).*

The risk information provided in this section was developed to meet the requirements identified in the ~~HFFACO Appendix I~~Consent Decree. Information is provided for two main categories of impacts: (1) long-term human health risk associated with use of groundwater and (2) long-term human health risk associated with inadvertent post-closure human intrusion. Uncertainty or sensitivity evaluations of the impact of changes in assumptions, (e. g. concentration or K_d variation) will be provided in DOE/ORP-2005-01, *Initial Single-Shell Tank System Performance Assessment for The Hanford Site.*

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